SOV/162-58-3-24/26

The Influence of Cadmium on the Electrical, Optical and Photo-Electrical Properties of Cadmium Sulfide

7 graphs, 1 table and 4 Soviet references.

ASSOCIATION: Kafedra poluprovodnikovych priborov Moskovskogo energeticheskogo instituta ... (Chair of Semiconductor devices of the Moscow Institute of Power Engineering)

SUBMITTED: June 7, 1958

Card 3/3

SHALIMOVA, K.V.; VERDANYAN, V.I.; TERNOVYKH, Yu.P.

Electric and optical properties of thin layers of germanium and silicon. Nauch.dokl.vys.shkoly; radiotekh.i elektron. no.4:232-238 '58.   (MIRA 12:6)

1. Kafedra poluprovodnikovykh priborov Moskovskogo energeticheskogo instituta.
                (Germanium)   (Silicon)

23809

S/020/61/138/001/013/023
B104/B201

26.2421

AUTHORS: Shalimova, K. V., Travina, T. S., and Golik, L. L.

TITLE: Optical absorption of polycrystalline CdS layers

PERIODICAL: Doklady Akademii nauk SSSR, v. 138, no. 1, 1961, 90-92

TEXT: The cadmium sulfide layers submitted to an investigation by the authors were prepared by sputtering on glass or quartz bases in vacuo, in argon or hydrogen sulfide atmosphere. As may be seen from results presented graphically in Figs. 1 and 2, the absorption spectra are complicated. It has not been possible on some of the films to obtain the required optical density for a given spectral region, the instrument being too little sensitive in certain cases. The sections of the respective curves are indicated by points in the diagrams. In most of the specimens concerned, the absorption could be measured from $\lambda = 150$ mμ on; in some of them in the shorter-wave region and with an absorption maximum at 230 mμ. Absorption in the visible region amounts to some percents of that in the ultraviolet. It is inferred from the different kinds of absorption in the region of 300-500 mμ that absorption is in this case caused by impurities.

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3809

Optical absorption of polycrystalline...   S/020/61/138/001/013/023
B104/B201

In the investigation concerned, the impurities were free Cd and S atoms arising from dissociation in the process of the specimen production. As is shown by the authors in a thorough discussion, excess Cd atoms are the most manifest here. Results show that specimens prepared in vacuo, argon-, and hydrogen-sulfide atmosphere all have the same complicated absorption spectrum. The kind of absorption must therefore be the same. All the specimens have an absorption maximum at $\lambda = 230$ mμ. A number of more or less clearly marked maxima (320 mμ, 420 mμ, 490 mμ) caused by excess Cd atoms are found in the region of 500 – 550 mμ. It is shown in a brief discussion that in the abovementioned spectral range electrons in the impurity centers are transferred from the normal level to an excited level by the energy of the exciting light. Cd atoms have the following three excitation levels in the CdS lattice: 3.85; 2.94, and 2.52 ev. There are 2 figures and 4 references: 2 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Institute of
Power Engineering)

PRESENTED: December 26, 1960, by V. N. Kondrat'yev, Academician

SUBMITTED: December 20, 1960
Card 2/4

23831
S/020/61/138/002/014/024
B104/B207

9,4160
26.2421

AUTHORS: Shalimova, K. V., Travina, T. S., and Rezvyy, R. R.

TITLE: Photoconductivity of polycrystalline cadmium-sulfide layers

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 138, no. 2, 1961, 334-337

TEXT: The authors studied the photoconductivity of polycrystalline CdS layers in a broad range of wave lengths of the exciting light. The production methods of the layers were considered in this connection. The layers were produced by sputtering onto insolating base layers (glass, quartz) in vacuum ($5 \cdot 10^{-5}$ mm Hg), in argon atmosphere and hydrogen sulfide atmosphere (1.0 - 0.5 mm Hg). The base layer temperatures ranged between room temperature and 550°C, the films attained a thickness of between $2 \cdot 10^{-6}$ and $2 \cdot 10^{-4}$ cm. 600 specimens were prepared. Studies were carried out by means of a 3MP-3 (ZMR-3) mirror monochromator with quartz lens; a ДКСШ-1000Б (DKSSh-1000B) xenon direct-current valve served as light source. The specimens were subjected to light pulses of a frequency of 36 ± 0.5 cps. The electrical plant consisted of an electric measuring stage, a broad-band amplifier, a millivoltmeter and an ЭО-7 (EO-7) oscilloscope. All measure-

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S/020/61/138/002/014/024
B104/B207

Photoconductivity of polycrystalline...

ments were made in the linear part of the characteristic of the specimens. The photocarrier life-time τ of some specimens was determined. No photo-sensitivity was found to exist in specimens, produced by sputtering CdS in vacuum and argon, whose base layer was at room temperature. Layers sputtered in a vacuum onto a base layer with a temperature of 150°C, showed also no photoconductivity. The resistivity of these layers was 10^{-2} ~ 1 ohm·cm. Specimens prepared in hydrogen-sulfide atmosphere and which had a resistivity of 1 - 10 ohm·cm, were also not photoconductive. Photocurrents occurred, however, in specimens with a resistivity of 100 ohm·cm. Specimens sputtered onto a base layer pre-heated to more than 300°C, showed a stable photoconductivity. This holds for all three kinds of atmosphere. The conditions under which the layers had been produced exerted no influence upon photoconductivity when the base layers were pre-heated to 450°C. The results of Figs. 1 and 2 show that the photo-current depends in a complex manner on the wavelength of the exciting light. Two maxima occur in the 225-700 mμ range. The maximum of the less-sensitive specimens lies in the visible range ($\lambda = 510$ mμ), while the highly sensitive specimens posses a broader maximum in the UV. According to the authors' measurements, the photocarrier life-time determined from

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25031

Photoconductivity of polycrystalline...   S/020/61/138/002/014/024
B104/B207

the drop of light stream on interruption is $(1-6) \cdot 10^{-3}$ seconds. As the Figs. indicate, τ is practically independent of the wave length, except for the ranges in which the photoconductivity is not particularly large. In these ranges, life-time increases somewhat. Furthermore, the spectral distribution of the photoconductivity is independent of the layer thickness and the temperatures of base layer and medium. Photoconductivity depends, however, on the resistance of the layer. Resistance and photosensitivity of the layers increase with rising base layer temperature. There are 2 figures and 18 references: 5 Soviet-bloc and 13 non-Soviet-bloc.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Institute of Power Engineering)

PRESENTED: December 26, 1960, by V. N. Kondrat'yev, Academician

SUBMITTED: December 8, 1960

Card 3/5

Effect of temperature on the optical ...

25864
S/020/61/139/004/024/025
B127/B212

$300^{\circ}C$, showed green luminescence. The absorption spectrum showed a complex structure at $77.3^{\circ}K$. Fig. 1 represents the microphotographs of the spectra. Results clearly show that the absorption band of the spectrum in the range 4600-5070 Å depends on the mode of formation of samples. At low temperatures, it is closely connected with luminescence. The substances studied displayed one or two maxima which depended on the production technology of preparations; they were, however, independent of the layer thickness. There are 1 figure and 6 references: 5 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute)

PRESENTED: March 17, 1960, by V. N. Kondrat'yev, Academician

SUBMITTED: March 15, 1961

Card 2/3

S/070/62/007/003/004/026
E132/E460

AUTHORS: Shalimova, K.V., Andrushko, A.F.

TITLE: Electron and X-ray diffraction studies of the
             structures of thermally treated powders of cadmium
             sulphide

PERIODICAL: Kristallografiya, v.7, no.3, 1962, 371-373 + 1 plate

TEXT: CdS can occur with either the hexagonal, alpha, high-
temperature form (wurtzite type) or with the cubic, beta, low-
temperature structure.   The effect of heat treatment in various
atmospheres (H_2S, He, H_2, air) on mixtures of the two forms
has been studied by X-ray and electron diffraction.   It was
concluded that at temperatures below 490 to 520°C both forms are
substantially stable.   At higher temperatures the cubic form goes
to the hexagonal.   In air the transition temperature is 525 ± 5°C
and in vacuo 495 ± 5°C.   At temperatures above 700°C in vacuo
and in air recrystallization proceeds strongly and the particles
of alpha-CdS grow from 0.1 — 1.0 to 10 - 30 microns or more.
On heating in air at 520 to 660°C, considerable oxidation takes
place with the formation of sulphates.   After heating at 700°C,
Card 1/2

ANDRUSHKO, A.F., prepodavatel'; VORONKOV, E.N., prepodavatel',
KUBETSKIY, G.A., prepodavatel', MALYSHEV, G.A., prepodava-
tel'; SETYUKOV, L.I., prepodavatel'; SOKOLOV,A.A., prepodavatel';
KHIRIN,A.A.,prepodavatel!; SHALIMOVA,K.V., prof.; ENYUTIN, V.V.,
reu., LARIONOV, G.Ye., tekhn. red.

[Specialized guide to semiconductors and semiconductor devices]
Spetsial'nyi praktikum po poluprovodnikam i poluprovodniko-
vym priboram. Moskva, Gos. energ. izd-vo, 1962. 303 p.
(MIRA 15:2)
(Semiconductors)   (Transistors)

L 12790-63   BDS/EWP(q)/EWT(m)   AFFTC/ASD   JD
ACCESSION NR: AP3000784   S/0070/63/008/003/0461/0462

AUTHOR: Shalimova, K. V.; Morozova, N. K.; Soldatov, V. S.

TITLE: The crystalline structure of zinc-sulfide films

SOURCE: Kristallografiya, v. 8, no. 3, 1963, 461-462

TOPIC TAGS: crystal growth, crystal structure, ZnS, x-ray diffraction, A, HS

ABSTRACT: The authors made detailed studies of the crystal structure of ZnS
films in relation to temperature and material of the substrate and also in relation
to the atmosphere, structure of initial powder, and fusing temperature of this
powder. They prepared films from both cubical and hexagonal forms of powder on
glass and quartz substrates at temperatures from 20 to 800C. The experiments
showed that temperature of the evaporator and structure of the initial material
have no effect on the crystal structure of the films. This structure depends
chiefly on temperature of the substrate at the moment the film forms on it. It
also depends on the atmosphere in which the film is deposited and on the material
of the substrate. At lower temperatures (200-300C) the structure is generally that
of zinc blende if the substrate is glass, but it is hexagonal if the substrate is
quartz; and this film forms at somewhat lower temperature in a vacuum (220C) than
in HS (300C). Mixtures of both structures are deposited at higher temperatures,
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L 12790-63
ACCESSION NR: AP3000784

but the cubic phase is dominant on quartz substrates at a temperature of 700C, whereas films formed in the 400-470C range on glass substrates exhibit hexagonal structure exclusively. The cubic phase appears suddenly and abundantly, however, on cooling below 400C or heating above 470C. Orig. art. has: 4 figures. [Abstracter's note: 4 figures referred to in text but no graphics accompany article.]

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Institute of Power Engineering)

SUBMITTED: 27Dec62   DATE ACQ: 21Jun63   ENCL: 00

SUB CODE: 00   NO REF SOV: 002   OTHER: 007

Card 2/2

ACCESSION NR: AP4036564

S/0139/64/000/002/0098/0104

AUTHORS: Shalimova, K. V.; Morozova, N. K.

TITLE: On the nature of absorption in zinc sulfide

SOURCE: IVUZ. Fizika, no. 2, 1964, 98-104

TOPIC TAGS: optical absorption, polycrystalline structure, stoichiometric composition, spectrograph ISP 28, hexagonal specimen, crystal structure, film substrate, excitation level, zinc sulfide, Hitachi spectrophotometer

ABSTRACT: Optical absorption in thin polycrystalline ZnS layers was studied as a function of its stoichiometric composition. Measurements were taken on thin films by using an Hitachi spectrophotometer at room temperatures and with a spectrograph ISP-28 at 77K. Three absorption regions were observed with specimens containing excess zinc atoms (at 220, 240-260, and 300-340 mμ). The hexagonal specimens exhibited six bands with maxima at 3085, 3120, 3164, 3190, 3210, and 3224 Å at 77K. Films with cubical crystal structure showed three bands with maxima at 3214, 3273, and 3290 Å. Raising the surplus zinc atom concentration above its stoichiometric value sharply increased absorption in the 240-260 and 300-340 mμ regions, while

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ACCESSION NR: AP4036564

decreasing this concentration reduced the absorption in the corresponding bands. Optical absorption was also increased by raising the heating temperature of the film substrate. It is shown that ZnS absorption in the 240-260 and 300-340 mμ regions is determined by electron transitions in excess zinc atoms from $4s^2 1S_0$ ground level to the excitation levels of $4s4p\,^1P_1$ and $4s4p\,^3P_{0,1,2}$ respectively. In the hexagonal crystal specimens these excitation levels are thought to be caused by $j + 1$ splitting of the energy levels (j - internal quantum number). Orig. art. has: 3 figures.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Institute of Power Engineering)

SUBMITTED: 19Jul63   DATE ACQ: 05Jun64

SUB CODE: GP, GC   NO REF SOV: 011   ENCL: 00

                                                              OTHER: 007

Card: 2/2

ACCESSION NR: AP4036565   S/0139/64/000/002/0104/0109

AUTHORS: Shalimova, K. V.; Morozova, N. K.

TITLE: Temperature dependence of absorption spectra of zinc sulfide polycrystalline films

SOURCE: IVUZ. Fizika, no. 2, 1964, 104-109

TOPIC TAGS: absorption spectra, fused quartz, ultraviolet light, spectrograph, cubic lattice, wavelength, temperature displacement coefficient, single crystal, spectrograph ISP 28, ultraviolet lamp GSVD 120

ABSTRACT: The absorption spectra of ZnS were studied (with an ISP-28 type spectrometer) as a function of temperature from 77K to room temperature. The speci-mens were prepared by vacuum deposition on fused quartz in argon and hydrogen sulfide atmospheres. A GSVD-120 lamp served as a source of ultraviolet light. The cubic lattice specimens showed three absorption bands at 77K (3210, 3273, and 3290 Å). Of these, only two are visible at room temperature (wavelengths of 3280 and 3360 Å). The 3273 Å band showed a temperature displacement coefficient equal to 4.5 x 10^{-4} ev/degree, and the 3210 Å band of 3.3 x 10^{-4} ev/degree. The cubical

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ACCESSION NR: AP4036565

lattice specimens with hexagonal traces showed absorption bands of 3120, 3190, 3217, 3273, and 3290 Å at 77°K. These shifted toward greater wavelengths when the temperature was raised to 293K. A table is presented for comparing the temperature displacement coefficients of single crystal, powder, and polycrystalline film specimens of α and β-ZnS. The shift in absorption bands is attributed to transition of electrons on various active levels with different degrees of forbiddenness. Orig. art. has: 4 figures and 1 table.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Institute of Power Engineering)

SUBMITTED: 19Jul63   DATE ACQ: 05Jun64   ENCL: 00

SUB CODE: GC, GP   NO REF SOV: 009   OTHER: 004

Card 2/2

S/0139/64/000/003/0134/0139

ACCESSION NR: AP4041853

AUTHORS: Shalimova, K. V.; Travina, T. S.; Potapov, Yu. V.; Starostin, V. V.

TITLE: Electric properties of polycrystalline cadmium sulfide films

SOURCE: IVUZ. Fizika, no. 3, 1964, 134-139

TOPIC TAGS: cadmium sulfide, thin film, sublimated film, carrier density, carrier mobility, Hall effect, electric conductivity

ABSTRACT: The purpose of the research was to study and to learn to control the electric properties of sputtered layers of cadmium sulfide. The thin polycrystalline films were obtained by evaporating nonluminescent cadmium-sulfide powder in vacuum (10^{-5}--10^{-6} mm Hg) and also in spectrally pure argon and hydrogen sulfide (0.5--1 mm Hg). The substrate was insulating and its temperature could be varied and controlled. The evaporator of the initial material could also be

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ACCESSION NR: AP4041853

varied from 500 to 1100C. The electric conductivity and the Hall
effect in these film specimens were investigated as functions of the
sublimation temperature of the initial substance, and also of the
medium in which the films were sputtered, and the substrate tem-
perature at the instant of condensation of the semiconductor layer
on the substrate. Data are given on the electric conductivity of
these layers as functions of the medium, sputtering of the initial
powder, its sublimation temperature, heating of the substrate on
which the specimen is deposited, and the thickness of the sample.
The Hall-effect measurements of cadmium-sulfide films obtained under
different technological conditions are used to calculate the mobility
and density of the carriers. A connection is established between
the mobility and the density or thickness of the layer. The experi-
mental and theoretical data are compared. It is concluded that at
the instant when the sulfide layer is sputtered, excess cadmium
atoms penetrate into it, and these determine the dark conductivity
of the sample, along with exerting an influence on the scattering of

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ACCESSION NR: AP4041853

the carriers. There is no rigorous theory of carrier scattering in
thin semiconductor layers but approximate calculations show that the
scattering on the surface of the layer and on the boundaries between
individual crystallites can greatly reduce the mobility. This dis-
tinguishes the produced films from single crystals of cadmium sul-
fide and probably explains the dependence of the electric conductiv-
ity on the layer thickness. Orig. art. has: 5 figures.

ASSOCIATION: None

SUBMITTED: 00   ENCL: 03

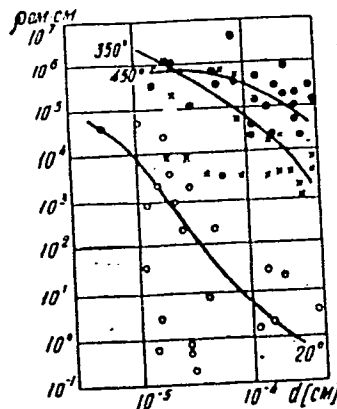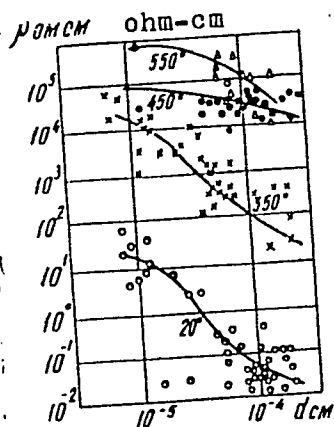SUB CODE: SS   NR REF SOV: 002   OTHER: 007

Card   3/6

ENCLOSURE: 01

ACCESSION NR: AP4041853

Dependence of resistivity on the thickness of cadmium sulfide films obtained in the following manner: Left - by sputtering the initial powder in an argon atmosphere on substrates heated to 20, 350, 450, and 550C. Right - by sputtering in a hydrogen sulfide atmosphere on specially heated substrates, and also on substrates heated to 350 and 450C

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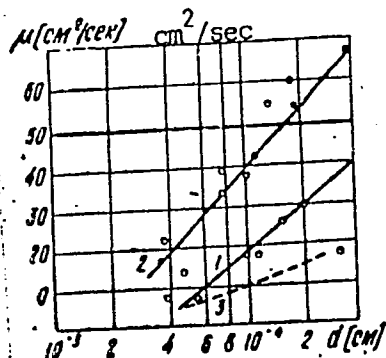ACCESSION NR: AP4041853
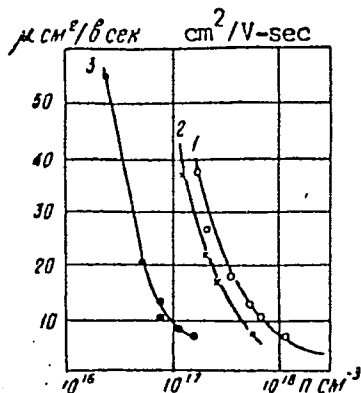
ENCLOSURE: 02
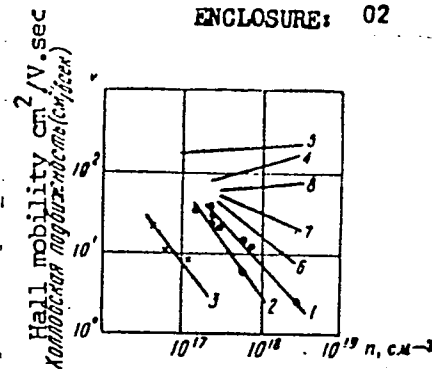
Dependence of carrier mobility on their density in cadmium sulfide. Left - obtained by vacuum sputtering and having different resistivities. Right - 1, 2, 3 - experimental data on films, 4, 5 - data on single crystals obtained elsewhere, 6, 7, 8 - theoretical curves for several densities.

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Dependence of carrier mobility in cadmium sulfide films on their thickness. 1 - films sputtered in vacuum on heated substrates (180C); carrier density $2.3 \times 10^{17} \text{cm}^{-3}$. 2 - films sputtered in argon atmosphere on substrates heated to 260C; carrier density $2.6 \times 10^{18} \text{cm}^{-3}$. 3 - theoretical dependence of carrier mobility on sample thickness.

Card 6/6

ACCESSION NR: AP4041854   S/0139/64/000/003/0139/0143

AUTHORS: Shalimova, K. V.; Travina, T. S.; Stopachinskiy, V. B.

TITLE: Concerning the nature of optical absorption of polycrystal-
line films of cadmium sulfide

SOURCE: IVUZ. Fizika, no. 3, 1964, 139-143

TOPIC TAGS: thin film, sublimated film, absorption spectrum,
excitation spectrum, cadmium sulfide

ABSTRACT: This is a continuation of earlier work by some of the
authors (K. V. Shalimova, I. V. Karpenko, NDVSh, Radiotekhnika i
elektronika, v. 2, 233, 1958; K. V. Shalimova, T. S. Travina, L. L.
Golik, DAN SSSR v. 138, 1, 1961). In the present work, new data are
given for thin layers of cadmium sulfide containing different amounts
of cadmium atoms in excess of stoichiometric composition. The
methods of preparing the films and the test procedure are briefly

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ACCESSION NR: AP4041854

described. The experiments on absorption spectra have shown that if the layer is deposited from vapor of the initial substance in which there are no free cadmium atoms or else there is an excess of sulfur atoms, then the absorption of the compounds is very small in the visible region. Such layers were prepared by sublimation without dissociation of the sulfide. The strong absorption of the visible region of the spectrum observed in some cases can be greatly reduced by heating the samples in sulfur vapor. Results are described of the absorption spectra of the films, as functions of the medium in which the initial powder was sputtered, its sublimation temperature, and the heating of the substrate on which the sample was deposited. The optical density of the compounds obtained by simultaneous subli- mation of cadmium sulfide and metallic cadmium is examined, and also the influence of heat treatment of the sputtered layers in sulfur vapor. On the basis of the obtained experimental data it is con- cluded that the absorption of cadmium sulfide in the visible or near ultraviolet regions has an impurity character. The investigations of films produced by different methods gave practically the same results,

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ACCESSION NR: AP4041854

which can be summarized as follows. 1. Strong absorption of CdS
in the visible and the near ultraviolet region is observed only in
the samples activated with cadmium. 2. Two maxima are observed in
the region of impurity absorption (320 and 420 millimicrons), if the
substances are made on specially heated substrates. If the sub-
strate is heated to 450C, the maxima are located at 380 and 490
millimicrons. This indicates that the cadmium impurity in the sul-
fide lattice has two excitation levels. 3. In the far ultraviolet
the cadmium sulfide films have a strong absorption band with a maxi-
mum at 230 millimicrons which can be shown to be due to intrinsic
absorption of the cadmium sulfide. The value of the absorption co-
efficient (10^5--10^6 cm^{-1}) indicates that the absorption is due to
direct optical transitions of the electron film in the valence band
to the conduction band. Consequently, the width of the forbidden
band for the direct optical transitions should be 5.3 eV. Orig. art.
has: 4 figures.

ACCESSION NR: AP4041854

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power
Engineering Institute)

SUBMITTED: 05Jan63   ENCL: 00

SUB CODE: OP, SS   NR REF SOV: 007   OTHER: 002

L 12432-65   EWT(m)/EWP(t)/EWP(b)   IJP(c)/BSD/SSD/AS(mp)-2/ESD(gs)/ESD(t)   JD

ACCESSION NR: AP4047340   S/0139/64/000/005/0008/0011

AUTHORS: Shalimova, K. V.; Andrushko, A. F.; Khirin, V. N.; Morozova, N. K.

TITLE: Optical properties of powders of cadmium sulfide of hexagonal modification at 77.3K

SOURCE: IVUZ. Fizika, no. 5, 1964, 8--11

TOPIC TAGS: cadmium sulfide, luminescence spectrum, luminescence analysis, polycrystal, reflection band, optical absorption

ABSTRACT: Inasmuch as earlier research on the fine structure in the absorption, reflection, emission and excitation of luminescence of hexagonal-modification cadmium sulfide was limited to single-crystal samples and thin films deposited on heated substrates, the authors have undertaken to determine the dependence of the optical properties of the hexagonal modification of cadmium sulfide on the condi-

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L 12432-65

ACCESSION NR: AP4047340   O

tions under which it is obtained. α-CdS powders with fine crystalline structure, obtained by different means at different temperatures and with different reagents, were used in the investigations. All the spectra were obtained in unpolarized light at liquid-nitrogen temperature. The reflection spectra were obtained with the ISP-51 spectrograph with UF-84 camera, while the radiation and excitation spectra were investigated with the same spectrograph but with an FEP-1 photoelectric attachment. The tests were made in the 4600--5400 Å range. The powders have five reflection bands at liquid-nitrogen temperature, and the luminescence excitation spectra display six maxima. A comparison of these spectra indicates that each maximum of reflection corresponds to a maximum of excitation. The emission of cadmium-sulfide powders lies in the blue and green regions of the spectrum. The blue band has two maxima with positions that vary from sample to sample, while the green band has four maxima at 5146, 5223, 5295, and 5390 Å. The differences in the spectra depend on the preparation. The results indicate that the opti-

Card   2/3

ACCESSION NR: AP4047340

cal absorption in the cadmium sulfide is due to impurities and is connected with the violation of the stoichiometry of the crystals. Orig. art. has: 3 figures.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Engineering Institut)

SUBMITTED: 28Apr63   ENCL: 00

SUB CODE: OP,IC   NR REF SOV: 009   OTHER: 003

Card   3/3

L 13079-65   EWT(m)/EWP(t)/EWP(b)   IJP(c)/AEDC(a)/AS(mp)-2/ESD(c)/ESD(gs)

JD
ACCESSION NR: AP4047358   S/0139/64/000/005/0119/0124

AUTHORS: Shalimova, K. V.; Andrushko, A. F.; Khirin, V. N.; Moro- β
zova, N. K.

TITLE: Optical properties of powders of the cubic modification of
cadmium sulfide and their changes in the β → α phase transition

SOURCE: IVUZ. Fizika, no. 5, 1964, 119-124

TOPIC TAGS: cadmium sulfide, cubic crystal, powder, phase transi-
tion, light absorption, light emission

ABSTRACT: In order to obtain additional information on the mechanism
of absorption and emission of light in CdS, the authors investigated
the spectra of diffuse reflection, emission, and excitation of lu-
minescence of CdS powders of cubic modification, and also investigated
the spectra of β-CdS powders annealed at high temperatures in air and
in a helium atmosphere. All the spectra were investigated in unpo-

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L 13079-65
ACCESSION NR: AP4047358

larized light at liquid-nitrogen temperature. The reflection spec-
tra were obtained with an ISP-51 spectrograph with UF-84 camera. The
excitation and emission spectra were investigated with the same spec-
trograph and a photoelectric attachment. The cadmium sulfide powder
was precipitated from solutions and heat treated at temperatures from
100 to 1200C. One band is observed in βCdS in reflection and in
emission at 77K. After heating the β-CdS above 540C, this band at
5060--5070 Å gradually attenuates and vanishes, and is replaced by
the reflection peaks characteristic of the hexagonal modification
crystals. The emission and reflection spectra show a similar be-
havior. Orig. art. has: 3 figures.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power
Engineering Institute)

SUBMITTED: 28Apr63

SUB CODE: OP, SS

NR REF SOV: 010

ENCL: 00

OTHER: 003

Card 2/2

ACCESSION NR: AP4013487

S/0181/64/006/002/0351/0353

AUTHORS: Shalimova, K. V.; Pavlov, L. P.; Karetnikov, I. A.

TITLE: Structure of the spectra of the photocurrent in polycrystalline layers of cadmium sulfide

SOURCE: Fizika tverdogo tela, v. 6, no. 2, 1964, 351-353

TOPIC TAGS: photocurrent, polycrystalline layer, cadmium sulfide, modulated light, continuous light, semiconductor

ABSTRACT: This paper contains the results of investigations in the visible part of the spectrum. Experiments were made at room temperature and at the temperature of liquid nitrogen in both continuous and modulated light. Temperatures in the sublayer were varied from 200 to 500C. It was found that fine structure of the photocurrent spectrum is observed only in samples prepared on a sublayer with a temperature above 300C (sublayer temperatures were increased by intervals of 100C). The higher the temperature of the sublayer at the moment of sublimating the film, the sharper the structure. Maximums in the fine structure of photo-current correspond exactly to minimums in the absorption structure. Maximums of

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ACCESSION NR: AP4013487

fine structure of the photocurrent spectrum obtained in modulated light correspond exactly to maximums obtained in continuous light. Orig. art. has: 2 figures.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Institute of Power Engineering)

SUBMITTED: 20Jun63

DATE ACQ: 03Mar64

ENCL: 00

SUB CODE: OP,EC

NO REF SOV: 005

OTHER: 000

Card 2/2

ACCESSION NR: AP4041741   S/0181/64/006/007/2209/2212

AUTHORS: Shalimova, K. V.; Pavlov, L. P.; Rezvy*y, R. R. ·

TITLE: Space charge limited currents in polycrystalline cadmium sulfide films

SOURCE: Fizika tverdogo tela, v. 6, no. 7, 1964, 2209-2212

TOPIC TAGS: cadmium sulfide, thin film, space charge density, carrier mobility, current emission

ABSTRACT: In view of the lack of published data on the subject, the authors plotted the current-voltage characteristics of thin polycrystalline films produced by evaporating pure CdS powder in a vacuum of 10^{-5} mm Hg on glass substrates coated with gold or with lead dioxide. No definite comparison with theory could be made for the characteristics plotted at negative polarity using gold electrodes, which usually are barrier electrodes for CdS single crystals,

Card   1/4

Current-voltage characteristic of
CdS films: 1, 2, 3 - sputtered,
4, 5, 6 - annealed in air.

Resistivity (ohm-cm) and thickness
(microns): 1 - 2.7 x 10^2, 10.4;
2 - 2.3 x 10^3, 7.1;
3 - 5.4 x 10^4, 10:
4 - 5.7 x 10^2, 10.4;
5 - 2.6 x 10^5, 7.7;
6 - 1.4 x 10^7, 10.

I - theoretical characteristic

Card 3/4
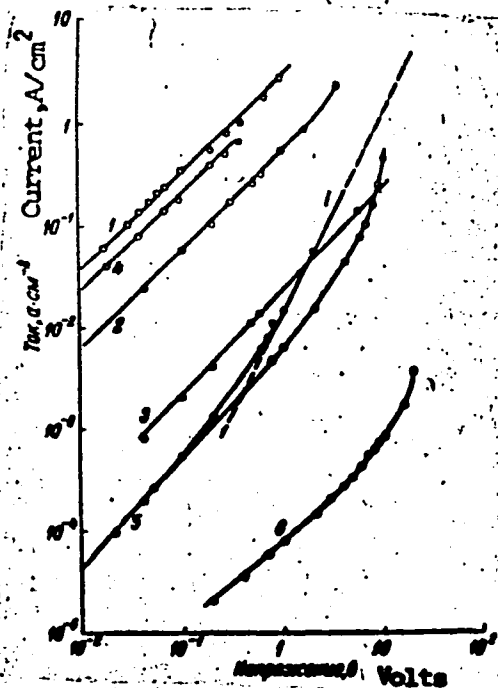
ACCESSION NR: AP4041741   ENCLOSURE: 02

Current-voltage characteristics
of silver-doped CdS films

Resistivity (ohm-cm) and
thickness, respectively:

1-6 - same as in Enc. 01
7 - 1.3 x 10^7, 5.1;
8 - 3.8 x 10^7, 4.4;
9 - 1.2 x 10^9, 9.7;
10 - 10^11, 2.5

Card 4/4
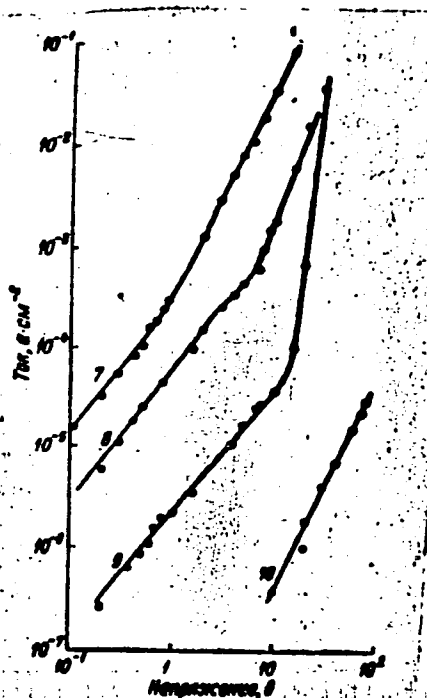
SHALIMOVA, K.V.; ANDRUSHKO, A.F.; DMITRIYEV, V.A.; PAVLOV, L.P.

Crystalline structure of CdS films precipitated on a glass
or metallized base and subjected to heat treatment.
Kristallografiia 9 no.3:418-419 My-Je '64.   (MIRA 17:6)

1. Moskovskiy energeticheskiy institut.

SHALIMOVA, K.V.; MOROZOVA, N.K.

Effect of excess zinc on the crystalline structure of ZnS.
Kristallografiia 9 no.4:559-560   Jl-Ag '64.

(MIRA 17:11)

1. Moskovskiy energeticheskiy institut.

L 11271-65   EWT(m)/EWP(t)/EWP(b) — ASD(a)-5/AS(mp)-2/AFWL/ESD(dp)/ESD(gs)/ESD(t)

ACCESSION NR: AP4046050   RDW/JD   S/0070/64/009/005/0741/0743

AUTHORS: Shalimova, K. V.; Andrushko, A. F.; Spy*nulesku-Karnary, I.;
Seredinskiy, B. P.

TITLE: Crystalline structure of ZnTe films at different deviations
from stoichiometric composition

SOURCE: Kristallografiya, v. 9, no. 5, 1964, 741-743

TOPIC TAGS: crystal lattice structure, zinc alloy, tellurium alloy,
thin film, stoichiometry

ABSTRACT: The purpose of the investigation was to determine the
effect of changes in the ratio of the components on the crystal
structure of zinc-telluride films, inasmuch as such data are missing
from the earlier papers on this alloy. The investigations were
made on films produced by sublimating ZnTe powder on glass substrates
preheated to different temperatures. Several different techniques

Card 1/3

L 11271-65.
ACCESSION NR: AP4046050 O

were used for depositing the films. The films were prepared in
an argon atmosphere at pressures from 10^{-1} to 10^{-4} mm Hg, and at
substrate temperatures ranging from 70 to 500C. When the zinc tel-
luride films were made by sublimation of ZnTe powder alone, the
layers always consisted of crystals having a single cubic modifica-
tion. If zinc telluride was evaporated jointly with metallic zinc
to produce the film, the structural picture was entirely different,
depending on the substrate temperature. In addition, the phase com-
position of the resultant films varied with the argon pressure at
the instant of crystallization. It is therefore concluded that the
structure of thin films of zinc telluride depends to a considerable
degree on the relative content of its components in the crystal
lattice. Enriching the mixture with excess telluride results in
growth of cubic modification crystals exclusively. Increasing the
relative content of zinc results in the formation and growth of
hexagonal zinc telluride crystals. Other details in the differences
due to varying the composition are also brought out. Orig. art.

Cord 2/3

L 11271-65
ACCESSION NR: AP4046050

has: 3 figures.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute)

SUBMITTED: 01Jan64

SUB CODE: 88

NR REF SOV: 003

ENCL: 00

OTHER: 003

Card 3/3

ACCESSION NR: AP4020960   S/0051/64/016/003/0480/0483

AUTHOR: Shalimova, K.V.; Morozova, N.K.

TITLE: Temperature dependence of the reflection spectra of zinc sulfide single crystals of different modifications

SOURCE: Optika i spektroskopiya, v.16, no.3, 1964, 480-483

TOPIC TAGS: zinc sulfide reflection, zinc sulfide absorption, zinc sulfide, cubic zinc sulfide, hexagonal zinc sulfide, growth fault

ABSTRACT: The temperature dependence of the reflection and absorption spectra of zinc sulfide single crystals was studied in the range from 77°K to room temperature (20°C). The spectra were observed in the 300 to 370 mμ range. The investigated specimens included "perfect" cubic and hexagonal single crystals without activator and crystals doped with chlorine, as well as some specimens with growth faults. In all over 100 crystals were studied. The spectra were recorded by means of an ISP-28 spectrograph, using nonpolarized light. Considerable variation of the spectra was noted. In the case of some pure cubic specimens there is a sharp absorption edge at 3295 Å at 77°K, while other crystals of the same batch have either a diffuse edge

Card 1/2

ACCESSION NR: AP4020960

or exhibit complete transmission in the 3700 to 3000 $\overset{o}{A}$ range. In cases where fine structure is evinced, it consists of three peaks located at 3212, 3271 and 3286 $\overset{o}{A}$ (the 3212 and 3271 $\overset{o}{A}$ reflection bands were observed earlier by A.Lempicki and others, Proc.Internat.Conf.on Semiconductor Physics, Prague,1960). With increase of temperature above 77°K the reflection bands of the cubic crystals broaden, decrease in intensity, and shift to the red side. The hexagonal crystals also do not always exhibit fine structure in the absorption; some have only a sharp edge at 3200 $\overset{o}{A}$ (at 77). The crystals with frowth faults (such crystals are encountered among both the "pure" ones and the Cl doped crystals) of both modifications are characterized by the strongest reflection lines at 3271, 3040, 3224 and 3168 $\overset{o}{A}$; moreover, whereas the "cubic" 3271 $\overset{o}{A}$ line retains its position in the spectrum, the hexagonal lattice lines are shifted 48, 34 and 30 $\overset{o}{A}$ to the long wavelength side. The temperature dependences of the reflection bands are shown in figures. Orig.art.has: 3 figures.

ASSOCIATION: none

SUBMITTED: 20May63   DATE ACQ: 02Apr64   ENCL: 00

SUB CODE: PH   NR REF SOV: 005   OTHER:002

Card 2/2

SHALIMOVA, K.V.; MOROZOVA, N.K.

    Diffuse reflection spectra of zinc sulfide powders of various
    crystalline modifications. Opt. i spektr. 16 no. 4:659-662
    Ap '64.   (MIRA 17:5)

ACCESSION NR: AP4035477   S/0051/64/016/005/0866/0868

AUTHOR: Shalimova,K.V.; Morozova, N.K.

TITLE: Effect of preparation procedure on the optical absorption and reflection of polycrystalline zinc sulfide layers

SOURCE: Optika i spektroskopiya, v.16, no.5, 1964, 866-868

TOPIC TAGS: zinc compound, phosphor, absorption spectrum, reflection spectrum, thin film.

ABSTRACT: It was shown in an earlier paper by the authors (Kristallographiya,8, 461,1963) that the crystal structure of zinc sulfide films prepared by evaporation depends to a considerable degree on the deposition procedure. It would be reasonable to expect the absorption and reflections spectra of such films to vary as well. The purpose of the present study was to confirm this. As before, the films were prepared by evaporation-sublimation in vacuum, argon or hydrogen sulfide on fused quartz and glass backings heated to different temperatures from 200 to 800°C. The spectra were recorded at 77°K by means of an ISP-28 spectrograph. It was found that the predominant factor where the optical properties of the zinc sulfide films are concerned is

Card 1/3

L 16431-65   EWT(m)/EWP(t)/EWP(b)   IJP(c)/ESD(gs)   JD
S/0051/64/017/005/0788/0790
ACCESSION NR: AP4048755

AUTHORS: Shalimova, K. V.; Andrushko, A. F.

TITLE: Study of phase transformations in CdS by means of the diffuse reflection spectra

SOURCE: Optika i spektroskopiya, v. 17, no. 5, 1964, 788-790

TOPIC TAGS: cadmium sulfide, reflection spectrum, fine structure, phase transition, phase analysis

ABSTRACT: The authors' experiments have shown that almost all hexagonal cadmium-sulfide has the same group of fine-structure bands in the reflection spectrum at 77K, but amorphous powders, or powders having a structure with packing defects, show no such bands. This difference has made it possible to carry out an optical phase analysis of freshly prepared and heat treated CdS powders. The authors tested in particular powders prepared in the "Krasny*y

Card 1/2

L 16431-65
ACCESSION NR: AP4048755

2

khimik" plant and annealed in air at temperatures 400--1200C.   The
distinguishing features of the spectra obtained for different anneal-
ing temperatures are discussed, and it is concluded that a β → α
phase transition takes place following annealing above 500C.   "The
authors thank N. K. Morozova for help with the experiments."   Orig.
art. has: 2 figures.

ASSOCIATION: None

SUBMITTED: 13Nov63   ENCL: 00

SUB CODE: OP   NR REF SOV: 005   OTHER: 002

Card 2/2

L 39414-65   EWT(1)/EWT(m)/EWP(t)/EWP(b)   P1-4   IJP(c)   JD

S/0139/65/000/001/0080/0084

ACCESSION NR: AP5006056

AUTHOR: Shalimova, K. V.; Khirin, V. N.; Korolev, O. I.

TITLE: Photoluminescence of polycrystalline films of cadmium sulfide at 77K

SOURCE: IVUZ. Fizika, no. 1, 1965, 80-84

TOPIC TAGS: photoluminescence, cadmium sulfide, polycrystal, thin film, spectral composition, luminescence excitation, fine structure

ABSTRACT: A study was made of the spectra of absorption, reflection, emission, and luminescence excitation of polycrystalline CdS films at 77K, in the wavelength range 4500—5500 Å. These investigations are of interest because a detailed study of photoluminescence of CdS films was never made before. The films were obtained by thermal sublimation of powder in an atmosphere of argon or hydrogen sulfide in vacuum with subsequent crystallization on heated and unheated substrates. Samples sublimated on substrates heated below 350C, regardless of the atmosphere in which they were prepared, have absorption and emission spectra of simple form. Films sputtered on substrates heated above 350C have a fine structure in the absorption,

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L 39414-65
ACCESSION NR: AP5006056

reflection, luminescence excitation, and emission spectra, due to transitions be-
tween the ground level of the excess cadmium atom and its excited levels. Four
maxima at 4545, 4605, 4670, and 4740 Å were observed in the excitation spectra of
blue luminescence. The spectral distribution of the luminescence of the films was
independent of the exciting wavelength in the 2200—4900 Å range. A fine structure
in the absorption, reflection, luminescence excitation, and emission spectra was
observed only for films having hexagonal-symmetry lattices. Orig. art. has:
3 figures.

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Engineering Insti-
tute)

SUBMITTED: 28Apr63   ENCL: 00   SUB CODE: OP, SS

NR REF SOV: 019   OTHER: 001

mL
Card 2/2

L. 4541-66   EWT(1)/EWT(m)/EWP(i)/T/EWP(c)/EWP(b)   IJP(c)   JD/GG

ACC NR: AT5025642   SOURCE CODE: UR/2657/65/000/013/0306/0311

AUTHOR: Shalimova, K. V.; Gulyayev, A. M.; Shnitnikov, A. S.; Kalinina, O. B.

ORG: none

TITLE: Hall pickups based on thin layers of indium antimonide

SOURCE: Poluprovodnikovyye pribory i ikh primeneniye; sbornik statey, no. 13, 1965, 306-311

TOPIC TAGS: thin film transducer, Hall effect, thermoelectric sensor, magnetic field measurement, indium antimonide

ABSTRACT: Hall pickups prepared by K. G. Günter's three-temperature method were developed for use as functional elements in electronic systems and for measuring the strength and configuration of magnetic fields. Thin films of indium antimonide were used as semiconductor layers, with dimensions ranging from 0.4 x 1.2 mm to 4 x 8 mm. Four different types of pickups were developed. The first type, designed for use as functional elements in multipliers, dividers, and detectors, had overall dimensions of 10 x 15 mm with a semiconductor layer 3 x 3 mm in area. Two other types of pickups were designed for measuring magnetic fields and for use in automatic devices. The fourth type measured 1.2 x 0.4 mm and was developed for measuring the configuration of magnetic fields. The resistance of the pickups was less than 1000 ohm; sensitivity was 70—180 µv/oe. The relationships between the parameters of the pickups

Card 1/2   UDC: 621.382.61
                                            09010782

L 4541-66

ACC NR: AT5025642

and temperature, conditions of heat transfer, and magnetic field strength were studied. The pickups were successfully used in magnetic field measurements, especially, be- tween stators and rotors of electric machines. Orig. art. has: 3 figures. [JR]

SUB CODE:EMEC/ SUBM DATE: none/ ORIG REF: 001/ OTH REF: 005/ ATD PRESS: 4/35

Card 2/2

L 59505-65   EPF(n)-2/EPA(s)-2/EWA(c)/EWT(m)/EWP(i)/EWG(m)/EWP(b)/T/EWP(t)   Pt-7/
ACCESSION NR: AP5018717 Pu-4   IJP(c)   RDW/WW/JD/JG   UR/0070/65/010/004/0497/0500
                                        548.51:539.23

AUTHOR: Shalimova, K. V.; Andrushko, A. F.; Dima, I.

TITLE: Polymorphism of zinc selenide

SOURCE: Kristallografiya, v. 10, no. 4, 1965, 497-500, and insert facing p. 498

TOPIC TAGS: zinc selenide, thin film, zinc selenide crystallization, zinc selenide
sublimation, zinc selenide polymorphism

ABSTRACT: An experimental study has revealed the possibility of obtaining thin (up to
10 μ) films of zinc selenide, ZnSe, which were composed of 100% hexagonal crystals.
The films were grown by vaporization in vacuum of ZnSe powder on glass or quartz
substrate heated to 340C which forms an acute angle with the axis of the vaporizer
(crucible). This position of the substrate versus vaporizer creates scattering of
the atomic-molecular flow of the vapor, which is a necessary condition for formation
of exclusively hexagonal ZnSe crystals. Conditions were also established for the
formation of exclusively cubic or mixed cubic and hexagonal thin films. Moreover,
thin films were grown which were composed of ZnSe crystals having a structure in-
termediate between the cubic and hexagonal modifications. The effects of an excess

Card 1/2

L 59505-65

ACCESSION NR: AP5018717

of either selenium or zinc atoms in the crystallization or the annealing zone were established in respect to the stability of cubic and hexagonal phases in ZnSe thin films. Texturization in the films composed of cubic crystals was observed on electron and x-ray diffraction patterns. Crystallographic orientation of the films was determined in relation to the substrate. Lattice parameters of cubic and hexagonal crystals in thin films were calculated. The experimental data show development of polymorphism of ZnSe crystallized from the vapor phase under specified conditions.
Orig. art. has: 4 figures.   [JK]

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Institute)

SUBMITTED: 02Aug64   ENCL: 00   SUB CODE: SS

NO REF SOV: 006   OTHER: 002   ATD PRESS: 4053

Card 2/2

L 11937-66   EWT(1)/EWT(m)/T/EWP(t)/EWP(b)/EWA(c)   IJP(c)   JD

ACC NR: AP6001648   SOURCE CODE: UR/0051/65/019/006/0939/0942

AUTHOR: Shalimova, K.V.; Morozova, N.K.

ORG: none

TITLE: Narrow-line spectra of ZnS monocrystals with packing errors

SOURCE: Optika i spektroskopiya, v. 19, no. 6, 1965, 939-942

TOPIC TAGS: zinc sulfide, crystal growth, single crystal

ABSTRACT: It is established in this paper that in the spectra of zinc sulfide monocrystals with packing flaws in the 300 - 330 millimicron region at 77° K there may simultaneously appear bands characteristic of α- and β- ZnS, and also a number of lines which occupy an intermediate position between them.   The presence of two phases is also indicated by X-ray analysis.   A detailed study of the crystal structure and optical properties of crystals of this type was made by means of the Lauet method with stationary and rotating samples and the photographic method for analysis of the absorption and reflection spectra. The authors found that the spectral complexity alluded to is the result of a layer-by-layer alternation of cubic and hexagonal structures, and also of the deformation of individual layers within these crystals attributable to growth defects.   The type of packing present in falsely imposed layers can be deter- mined on the basis of an analysis of the optical spectra of the crystals.   A

Card 1/2   UDC: 535.34:548.0

L 11937-66

ACC NR: AP6001648

brief description is given of the structure types possible in the case of ZnS monocrystals. It is noted that great care should be taken in the study of the absorption and reflection spectral structures of these crystals, making this analysis only in conjunction with detailed X-ray observations. Authors make use of this opportunity to express their gratitude to Ye. V. Kolontsova for her assistance in this work. Orig. art. has: 4 figures.

SUB CODE: 20 / SUBM DATE: 31Aug64 / ORIG REF: 004

Card 2/2 pw

L 24365-66   EWT(1)/EWT(m)/EPF(n)-2/T/EWP(t)   IJP(c) JD/WW/JG/GG/AT
ACC NR: AP6008114   SOURCE CODE: UR/0139/66/000/001/0132/0136

AUTHORS: Shalimova, K. V.; Pavlov, L. P.; Karetnikov, I. A.

ORG: Moscow Power Engineering Institute (Moskovskiy energeticheskiy institut)

TITLE: Effect of crystal structure on the photoelectric properties of thin layers of cadmium sulfide

SOURCE: IVUZ. Fizika, no. 1, 1966, 132-136

TOPIC TAGS: crystal structure, photoelectric property, cadmium sulfide, photoconducting film, spectral distribution, temperature dependence

ABSTRACT: In view of the lack of published data on the effect of the technology of film preparation on the photoelectric properties of films, the authors have investigated the properties of polycrystalline cadmium sulfide films obtained by thermal evaporation in vacuum, and compared these data with those obtained by x-ray structure and electron-diffraction analysis. The samples were prepared by

Card   1/3

L 24365-66

ACC NR: AP6008114   18   /

thermal evaporation of spectrally pure cadmium sulfide <u>powder</u> in
vacuum at a pressure 10^{-5} mm Hg on glass or quartz substrates. The
substrate temperature ranged from 80 to 500C. The photocurrent spec-
tra were measured at room temperature in continuously applied light
using an optical system with double monochromatization; the results
were automatically recorded with an electronic potentiometer (EPP-09).
The error due to the inertia of the CdS layer was reduced by record-
ing the spectrum at a very slow rate. The spectral distribution of
the photocurrent, the absolute and relative photosensitivity, and the
relaxation time exhibited a strong dependence on the substrate tem-
perature. The higher the temperature, the higher the relative photo-
sensitivity and the smaller the absolute photosensitivity and the
smaller the time constant. These differences were related with the
number of defects in the polycrystalline layers and with their phase
composition. Annealing the layers decreased the photosensitivity in
a wide spectral range. This also points to the influence of the
phase composition. The maximum of the spectral distribution was
close to 550 nm. With increasing percentage of the cubic phase in
the cadmium sulfide, the maximum shifted towards longer wavelengths,

Card   2/3

L 24365-66
ACC NR: AP6008114

since the maximum of the cubic modification was located near 550 nm.
Orig. art. has: 3 figures and 1 table.

SUB CODE: 20/ SUBM DATE: 05Jan64/ ORIG REF: 004/ OTH REF: 004

Card   3/3

L 24364-66   EWT(1)/EWT(m)/ETC(f)/EWG(m)/T/EWP(t)   IJP(c)   RDW/JD/GG
ACC NR: AP 6008115   SOURCE CODE: UR/0139/66/000/001/0136/0141

AUTHORS: Shalimova, K. V.; Spynulesku, I.; Pirogova, N. V.

ORG: Moscow Power Engineering Institute (Moskovskiy energeticheskiy institut

TITLE: Effect of the conditions under which thin films of zinc telluride are obtained on their electric properties

SOURCE: IVUZ. Fizika, no. 1, 1966, 136-141

TOPIC TAGS: zinc compound, telluride, resistivity, thermoelectric power, semiconducting film, temperature dependence, semiconductor carrier, stoichiometry, crystal structure

ABSTRACT: The authors report on the results of an investigation of the resistivity and thermoelectric power of several sublimated p-type cubic-modification zinc telluride films, ranging in thickness, from 10^{-6} to 10^{-4} cm. The investigation was motivated by the fact that the contradictions in the results obtained by various authors were

Card   1/3

L 24364-66

ACC NR: AP6008115

apparently due to the differences in methods of preparation. The
samples were prepared at different evaporator temperature, different
distances between evaporator and substrate, and different degrees of
vacuum in the working system. The initial powder was sublimated on
glass and quartz substrates, which were either unheated (35C) or
heated to 100, 160, 200, 250, 300, 350, 400, and 450C. The powder
was sublimated in a vacuum of 3×10^{-5} and 3×10^{-3} mm Hg. The
quantities measured were the specific resistivity, and the thermo-
electric power. The sign of the carriers was also determined. The
resistivity was measured as a function of the thickness of the sample,
of the substrate heating temperature, and the evaporator temperature.
In addition, the temperature dependence of the conductivity of the
layers obtained under different conditions was measured. The results
showed that the coefficient of the thermoelectric power and the
resistivity of the films depend considerably on the method of prepara-
tion. This is due to changes in stoichiometry which occur under
various conditions. The results also show that the type of crystal
structure also has a pronounced effect, but heat treatment itself

Card   2/3

L 24364-66
ACC NR: AP6008115 O

does not. The thermoelectric power increased when the films were
heated in air (400 -- 440C), reaching in some cases a value 1000 --
1200 μV/deg. The electric conductivity had an irregular temperature
variation, but in most samples it increased with increasing tempera-
ture. Orig. art. has: 6 figures and 1 table.

SUB CODE: 20/ SUBM DATE: 16Jan64/ ORIG REF: 009/ OTH REF: 001

Card   3/3 plw

L 36510-66   EWT(1)/EWT(m)/EWP(w)/T/EWP(t)/ETI   IJP(c)   RDW/JD

ACC NR: AP6013464   SOURCE CODE: UR/0139/66/000/002/0133/0136

AUTHOR: Shalimova, K. V.; Dima, I.; Pirogova, N. V.

ORG: Moscow Power Engineering Institute (Moskovskiy energeticheskiy institut)

TITLE: Electric properties of polycrystalline film of zinc selenide of cubic modification

SOURCE: IVUZ. Fizika, no. 2, 1966, 133-136

TOPIC TAGS: zinc compound, selenide, resistivity, temperature dependence, polycrystalline film, semiconductor film, activation energy

ABSTRACT: In view of the discrepancy between the results obtained by different authors on the electric properties of zinc-selenide films, the authors have measured the specific resistivity and its temperature dependence for films made by sublimation of the original powder and also by sputtering of the two elements separately. This resulted in samples that differed greatly in their properties. The preparation of the films is briefly described. At room temperature, films obtained by supperting annealed powder had a resistivity larger than 10^9 ohm-cm. When the composition was enriched with an excess of selenium or zinc, the resistivity decreased by as much as three orders of magnitude. Films with excess zinc had n-type conductivity, and those with excess selenium p-type. The temperature dependence of the resistivity was measured in vacuum in the temperature range 300 - 700K for different substrate temperatures prior to deposition of the film. The increase of resistivity with decreasing

Card   1/2

L 36510-66

ACC NR: AP6013464

temperatures is approximately the same for all substrate temperatures, but the activation energy was found to depend strongly on the manner and temperature at which the film was produced. Films prepared by evaporation of the individual elements were also tested. Differences between the evaporation conditions and their effect on the temperature dependence are briefly discussed. Orig. art. has: 3 figures.

SUB CODE: 20/   SUBM DATE: 11Jul64/   ORIG REF: 002

Card 2/2 mLP

L 36396-66   EWT(m)/T/EWP(t)/ETI   IJP(c)   RDW/JD

ACC NR: AP6018784   (A)   SOURCE CODE: UR/0070/66/011/003/0480/0483

AUTHOR: Shalimova, K. V.; Bulatov, O. S.; Voronkov, E. N.; Dmitriyev, V. A.

ORG: Moscow Power Engineering Institute (Moskovskiy energeticheskiy institut)

TITLE: Producing cadmium telluride films with a hexagonal structure

SOURCE: Kristallografiya, v. 11, no. 3, 1966, 480-483

TOPIC TAGS: cadmium telluride, vacuum sublimation, crystal orientation, temperature dependence, x ray photography, x ray diffraction analysis, cubic crystal, crystal growth

ABSTRACT: A study was made of the crystal modification of CdTe films prepared by vacuum sublimation in argon (10^{-1}-10^{-2} mm Hg) on glass substrates heated from 70° to 400°C. The original CdTe material was sublimated at 500° to 800°C and had a cubic modification. Some specimens were prepared by evaporating pure Cd and Te in the sublimation chamber. The crystal structures of the grown crystals were analyzed by x-ray diffraction and electron microscopy. In all cases, only crystals with cubic modifications were formed, the thinner films having (111) parallel to the substrate; by decreasing the substrate temperature and increasing the thickness, this orientation disappeared. When the original material was simultaneously evaporated with metallic Cd and Te, the structure became hexagonally modified. X-ray patterns of the cubic and hexagonally mo-

UDC: 548.52 : 539.23

Card 1/2

L 42898-66   EWT(1)/EWT(m)/EWP(t)/ETI   IJP(c)   JD/RG

ACC NR: AP6018447

AUTHOR: Shalimova, K. V.; Khirin, V. N.; Korolev, O. I.

ORG: none

TITLE: Spectral distribution of relative quantum yield for photoluminescence of polycrystalline cadmium sulfide films at 77°K

SOURCE: Optika i spektroskopiya, v. 20, no. 6, 1966, 1063-1065

TOPIC TAGS: cadmium sulfide, photoluminescence, light excitation, excitation spectrum, absorption spectrum, spectrophotometry, quantum yield, monochromator, semiconducting film, polycrystalline film

ABSTRACT: The absorption, reflectance, excitation and quantum yield of luminescence from polycrystalline cadmium sulfide films at liquid nitrogen temperature (77°K) were investigated. In the corresponding spectra in the 210-360 mµ region, four broad bands with maxima at 330, 290, 240 and 215 mµ were observed while a fine structure consisting of 4-5 bands was observed in the 460-490 mµ region. The spectral distribution of green luminescence of polycrystalline CdS films is independent of the wavelength of the excitation light. The radiation intensity of this luminescence is directly proportional to the intensity of the excitation light over three orders of magnitude. These conclusions are based on a series of measurements carried out by the authors on hexa-

UDC: 535.37

Card 1/2

ABSTRACT: The object of the work was to study the narrow-line absorption spectrum (at 300-340 mμ) of polycrystalline ZnS films during a gradual decrease of the concentration of zinc in excess of the stoichiometric composition. This decrease was achieved by heating the samples in sulfur vapor. The optical absorption of ZnS single crystals heated in sulfur vapor was also studied. The narrow-line spectra of both polycrystalline and single-crystal ZnS were found to be highly sensitive to changes in the stoichiometric composition. The fact that the fine structure bands of ZnS in the 300-330 mμ range disappear on heating in sulfur vapor indicates that the excess zinc in the sulfide lattice is responsible for their presence in the spectra. The strong absorption at 300-330 mμ is measured against the background of the fundamental absorption of this compound, due to indirect interband transitions. As in the case of other semiconducting crystals, for example highly doped silicon, the probability of these transitions increases with the concentration of the zinc impurity in the ZnS lattice.

UDC: 535.34:549.321

Card 1/2

ACC NR: AF6033438

SOURCE CODE: UR/0051/66/021/004/0456/0459

AUTHOR: Shalimova, K. V.; Khirin, V. N.; Korolev, O. I.

ORG: none

TITLE: Temperature dependence of the absorption, reflection, emission, and excitation spectra and of the quantum yield of luminescence in polycrystalline films of cadmium sulfide

SOURCE: Optika i spektroskopiya, v. 21, no. 4, 1966, 456-459

TOPIC TAGS: cadmium sulfide, absorption spectrum, emission spectrum, excitation spectrum, quantum yield, luminescence spectrum, semiconducting film, temperature dependence

ABSTRACT: This is a continuation of earlier work (DAN SSSR v. 139, 938, 1961) on the temperature dependence of the absorption and reflection of cadmium sulfide films, where a photographic procedure was used. In the present study, the tested polycrystalline films were of hexagonal modification, and were prepared by a thermal sublimation of the initial substance in vacuum, using a procedure described by the authors elsewhere (Kristallografiya v. 8, 774, 1963). The temperature dependence of the spectra and of the quantum yield were measured with an optical system based on a spectrometer (DFS-12), universal monochromator (UM-2), a double monochromator (DMR-4), and a photoelectronic continuous spectrum recorder (FEP-1). The absorption spectra in the temperature range T: - 300K were plotted with a recording spectrophotometer SF-10. The

UDC: 535.34 + 535.37.096

Card   1/2

SHALIMOVA, Ninel' Il'inichna; ZYUZENKOV, I.P., red.; ATROSHCHENKO, L.Ye.,
tekhn. red.

[From ore to rolled stock] Ot rudy do prokata. Moskva, Izd-vo
"Znanie," 1960. 30 p.   (MIRA 14:6)
(Iron—Metallurgy) (Steel—Metallurgy) (Rolling (Metalwork))

SHALIMOVA, V.Ya., agronom, zaveduyushchiy uchastkom.

School experimental plot in the "School" pavilion. Est.v shkole
no.5:74-79 S-O '54.   (MLRA 7:9)
    (Moscow--Agricultural exhibitions) (Agricultural exhibitions--
    Moscow) (School gardens)

SERGEYEV, Ye. M., SHALIMOVA, Ye. M.

Nature of adhesiveness in soils. Vest. Mosk. un. Ser. biol.,
pochv., geol., geog. 14 no.3:157-160 '59.   (MIRA 13:6)

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universiteta.
                        (Soil physics)

SHALIN, A.

[The development of municipal economy in the U.S.S.R.] O razvitii gorodskogo khoziaistva v SSSR. [Moskva] Gos. izd-vo polit. lit-ry, 1953. 79 p.   (MLRA 6:11)
(Municipal services)

8

SHAPIRO, G.

Housing

House building in the fifth five-year plan. Arkhitektura 31, No. 5, 1953.

Monthly List of Russian Accessions, Library of Congress, June 1953. Uncl.

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2. USSR (600)

4. Bee Culture - Equipment and Supplies

7. Increasing the capacity of the hive. Pchelovodstvo 29 no. 12. 1952.

9. Monthly List of Russian Accessions, Library of Congress, ___April___ 1953, Uncl.

PETRIK, M.I.; SHALIN, G.M., inzh., retsenzent; SOMOVA, T.M., inzh.,
ved. red.; CHURMANOVA, V.V., tekhn. red.

[Precise adjustment of machine-tool brackets] Pretsizionnye
nastroiki gitar stankov; spravochnoe posobie. Moskva, Mash-
giz, 1963. 152 p. (MIRA 16:7)
                        (Machine tools)

VOTYAKOV, L.D.; IL'NITSKIY, I. I.; ANDERTON, V.V., CHALIN, G.M.

[Machine tools; a methodological manual] Metallorezhu-
shchie stanki; uchebno-metodicheskoe posobie. Sverdlovsk,
Ural'skii politekhn. in-t, 1963. 72 p.   (MIRA 17:9)

USSR / Cultivated Plants. Grains.   L.-3

Abs Jour: Ref Zhur-Biol., 1958, No 15, 72876.

Author   : Shalin, P. V.
Inst   : Stavropol'sk Scientific-Research Institute of Agri-
           culture.
Title   : Agricultural Engineering Requirements of Machines
           for Separate Combine Harvesting of Grains in Stav-
           ropol'skiy Kray.

Orig Pub: Byul. nauchno-tekhn. inform. Stavropol'sk. n.-i.
          in-ta s.kh., 1957, No 3, 40-42.

Abstract: No abstract.

Card 1/1
                              15

SHALIN, Pavel Vasil'yevich; SAZONOV, V.V., red.; SAYTANIDI, L.D., tekhn.
red.

[New efficient technology of plowing] Novaia effektivnaia tekhnologiia
vspashki. Moskva, Izd-vo M-va sel'.khoz. RSFSR, 1960. 62 p.
(MIRA 14:7)

(Plowing)

L 63534-65   EWT(1)/EWT(m)/EWP(b)/EWP(t)   IJP(c)   JD/JG
ACCESSION NR: AP5017802   UR/0286/65/000/011/0033/0033
                                                           669.187.26

AUTHOR: Barmotin, I. P.; Grechin, V. P.; Shalin, R. Ye.; Kachanov, Ye. B.

TITLE: Method of steel and alloy melting. Class 18, No. 171414

SOURCE: Byulleten' izobreteniy i tovarnykh znakov, no. 11, 1965, 33

TOPIC TAGS: steel melting, alloy melting, synthetic slag treatment, inert gas
blowing, rare earth element, metal deoxidation, rare earth element deoxidation

ABSTRACT: This Author Certificate introduces a method of melting steels and alloys
in which deoxidation of metal with rare-earth elements is performed simultaneously
with a treatment with synthetic slag and blowing with inert gas such as argon. [ND]

ASSOCIATION: Organizatsiya gosudarstvennogo komiteta po aviatsionnoy tekhnike
SSSR (Organization of the State Committee for Aviation Engineering, SSSR)

SUBMITTED: 23Jul64   ·   ENCL: 00   SUB CODE: MM

NO REF SOV: 000   OTHER: 000   ATD PRESS: 4050

Card   1/1

SABUROV, A.; TARASOV-AGALAKOV,N.; VOZYAKOV, V.; ZEMSKIY, M.; TROITSKIY,I.;
        RUBIN, A.; OBUKHOV, F.; POLOSUKHIN, M.; REMIZOV, A.; SHALIN, V.;
        MIKHAYLOV, F.

        Konstantin Moiseevich IAıchkov; obituary. Pozh.delo 3 No.6:11
        Je. '57.   (MLRA 10:7)
                        (IAichkov, Konstantin Moiseevich, 1873-1957)

L 16469-66   EWT(m)/EWP(t)   IJP(c)   JD/DM
ACC NR: AP6005533   SOURCE CODE: UR/0089/66/020/001/0054/0055

AUTHOR: Zeynalov, E. I.; Obaturov, G. M.; Shalin, V. A.; Chumbarov, Yu. K.   4 /.

ORG: none   B

TITLE: Using indium in neutron film badges

SOURCE: Atomnaya energiya, v. 20, no. 1, 1966, 54-55

TOPIC TAGS: radiation dosimeter, neutron radiation, gamma radiation, indium

ABSTRACT: The authors describe the IFKNG film badge with an indium intensifier
shield designed for thermal and intermediate neutrons and γ-radiation. A table is
given comparing the theoretical and experimental values for the relative effect of
thermal and intermediate neutrons on these badges. It is found that the IFKNG badge
may be used with RM-5-4 x-ray film for simple and accurate measurement of thermal
neutron doses from 0.005 rem, intermediate neutron doses from 0.03 rem and γ-radia-
tion doses from 0.015 r in mixed fields of neutron and γ-radiation from nuclear re-
actors. Orig. art. has: 1 figure, 1 table, 1 formula.

SUB CODE: 18/   SUBM DATE: 10Sep65/   ORIG REF: 000/   OTH REF: 000

                                              UDC: 539.107.37   Z
Card 1/1 MC

L 05055-67   EWT(m)/EWP(j)   IJP(c)   JR/GD/RM

ACC NR: AT6027930   SOURCE CODE: UR/0000/66/000/000/0150/0155

AUTHOR: Kayurin, Yu. P.; Shalin, V. A.

ORG: None

TITLE: Accumulation of gamma radiation from a plane isotropic source with an initial
energy of 1.25 Mev in laminar media consisting of polyethylene, iron and lead

SOURCE: Voprosy fiziki zashchity reaktorov (Problems in physics of reactor shield-
ing); sbornik statey, no. 2. Moscow, Atomizdat, 1966, 151-155

TOPIC TAGS: gamma radiation, polyethylene, lead, reactor shielding

ABSTRACT: Experiments are conducted to explain the behavior of accumulation factors
for γ-radiation from a plane isotropic source in laminar media. The source used was
Co^{60} in a medium made up of various combinations of polyethylene, iron and lead.
Recommendations are given for calculating the accumulation factors for γ-radiation in
laminar media based on the behavior of accumulation factors for $E_0=1.25$ Mev. A com-
parison with the results in the literature showed that accumulation factors may be
calculated in laminar media for higher energies. The experimental results show that
the accumulation factor in laminar media made from several materials for the case of
both plane and point isotropic sources lies below the highest and above the lowest

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L 05055-67

ACC NR: AT6027930

accumulation factors for the homogeneous materials used in the laminar medium. The
following empirical formula

$$B_{comp} = \sum_{n=1}^{N} B_n \left(\sum_{i=1}^{n} \mu_i x_i \right) - \sum_{n=2}^{N} B_n \left(\sum_{i=1}^{n-1} \mu_i x_i \right),$$

derived for calculating accumulation factors of γ-radiation from a point isotropic
source in laminar media may also be used for plane isotropic sources. This formula
may be used for higher energies since the energy dependence is accounted for in the
accumulation factors for homogeneous media and these factors are used as initial data
in calculating laminar media. Although this empirical formula gives a good descrip-
tion of the behavior of the accumulation factor in laminar media, computational diffi-
culty makes it inconvenient to use for media consisting of 3 or more materials. The
calculation of accumulation factors in shielding media consisting of 10-20 layers
with 2 or 3 different types of materials by using this formula gives an error of ±40%.
Layers of this type approach homogeneity and the order in which the layers are ar-
ranged loses its significance. The empirical formula

$$B'_{comp} = \sum_{i=1}^{n} \frac{a_i}{A} B_i (A)$$

Card   2/3

L 05055-57

ACC NR: AT6027930   /

where n is the number of materials making up the mixture, a_i is the total thickness of the layers made of the i-th material in terms of the mean free path, A is the total thickness of the mixture in terms of the mean free path, and $B_i(A)$ is the accumulation factor of the i-th material taken on the thickness of the entire mixture. This formula may also be used in the case of a medium consisting of 2 or 3 layers if the accumulation factors in the materials differ over the entire thickness by no more than 2 times. The authors thank Doctor of physical and mathematical sciences D. L. Broder for assistance in the work and discussion of the results. Orig. art. has: 5 figures, 3 formulas.

SUB CODE: 18/ SUBM DATE: 12Jan66/ ORIG REF: 006

Card   3/3

SHALIN, V.M., inzh.

Stabilization of the operation of an unbalanced bridge with
fluctuations in the power supply voltage. Nauch. trudy VIESKH
7:153-163 '60.   (MIRA 15:8)
                          (Bridge circuits)

SHALIN, V.N.

Standardization of compression and tension springs. Standartizatsiia
25 no.11:13-18 N '61.   (MIRA 14:11)
            (Springs (Mechanism)--Standards)

SHALIN, V.N., kand.tekhn.nauk

> Strength of helical compression springs. Izv.vys.ucheb.zav.;
> mashinostr. no.4:45-48 '62.   (MIRA 15:7)
> (Springs (Mechanism))

BURTSEV, Konstantin Nikolayevich; SHALIN, V.N., kand. tekhn.nauk,
        retsenzent; ZARINSKIY, O.N., inzh., red.; KUREPINA, G.N.,
        red. izd-va; SHCHETININA, L.V., tekhn. red.

        [Metal bellows] Metallicheskie sil'fony. Moskva, Mashgiz,
        1963. 159 p.   (MIRA 16:6)
                        (Bellows)

SOBOLEVSKAYA, K.A., prof., doktor biol. nauk, otv. red.; SHALINA,
        L.V., red.; SIMAKOVA, Ye.G., tekhn. red.

[Plant resources of Novosibirsk Province] Rastitel'nye bo-
gatstva Novosibirskoi oblasti. Otvet. red. K.A.Sobolevskaia.
Novosibirsk, 1961.   222 p.   (MIRA 15:3)

1. Akademiya nauk SSSR. Sibirskoye otdeleniye.
        (Novosibirsk Province—Botany, Economic)

BERDYSHEV. G.D.; SIPLIVINSKIY, V.N.; SHALINA, L.V., red.; LOKSHINA, O.A., tekhn. red.

[First Siberian professor of botany Korzhinskii; on the 100th anniversary of his birth] Pervyi sibirskii professor botaniki Korzhinskii; k 100-letiiu so dnia rozhdeniia. Novosibirsk, Izd-vo Sibirskogo otd-niia AN SSSR, 1961.   86 p.   (MIRA 15:7)
(Korzhinskii, Sergei Ivanovich, 1861-1900)

SHOKHINA, O.I.; LUCHITSKIY, I.V., doktor geol.-min.nauk, otv.red.; SHALINA,
    L.V., red.; MAZUROVA, A.F., tekhn.red.

[Alkali rocks of the Bulan-kul' massif (Krasnoyarsk Territory)]
Shchelochnye porody Bulan-Kul'skogo massiva (Krasnoiarskii krai).
Novosibirsk, Izd-vo Sib. otd. AN SSSR. 1961. 68 p. (Akademiia
nauk SSSR. Sibirskoe otdelenie. Institut geologii i geofiziki.
Trudy, no.10).   (MIRA 15:11)

1. Zaveduyushchiy Krasnoyarskoy kompleksnoy laboratoriyey Instituta
geologii i geofiziki Sibirskogo otdeleniya AN SSSR (for Luchitskiy).
              (Bulan-kul' Lake region—Rocks, Igneous)

TITARENKO, M.V.; KAGANOV, Z.G.; SHALINA, L.V., red.; VYALYKH, A.M.,
        tekhn. red.

    [Automatic control in power engineering] Avtomatika v ener-
    getike. Novosibirk, Izd-vo Sibirskogo otd-nie AN SSSR, 1962.
    45 p.   (MIRA 15:7)
            (Power engineering)   (Automatic control)

IL'YENKOV, A.I.; KLISTORIN, I.F.; SOBOLEV, V.S.; SHALINA, L.V.,
        red.; VYALYKH, A.M., tekhn. red.

[Transistor voltage regulators] Poluprovodnikovye stabi-
lizatory napriazheniia. Novosibirsk, Izd-vo sibirskogo
otd-niia AN SSSR, 1962. 51 p.   (MIRA 16:7)
              (Voltage regulators)

D'UNIH, Arkadiy Konstantinovich; SHALINA, L.V., red.; MAZUROVA,
        A.F., tekhn. red.

    [Mechanics of snowstorms; problems in the theory of de-
    signing means for snow control] Mekhanika metelei; vop-
    rosy teorii proektirovaniia snegoreguliruiushchikh sredstv.
    Novosibirsk, Izd-vo Sibirskogo otd-niia AN SSSR, 1963. 376 p.
                                                (MIRA 17:3)

SINITSYN, Boris Sergeyevich; TSAPENKO, M.P., dokter tekhn. nauk,
otv. red.; SHALINA, L.V., red.

[Automatic correlators and their applications] Avtomati-
cheskie korreliatory i ikh primenenie. Novosibirsk, Red.
izd. otdel Sibirskogo otd-niia AN SSSR, 1964. 215 p.
(MIRA 17:8)

KAGANOV, Zosim Grigor'yevich; TAGIROV, M.A., otv. red.; SHALINA,
L.V., red.

[Wave effects in electrical machines; approximate calcula-
tion methods] Volnovye iavleniia v elektricheskikh mashi-
nakh; priblizhennye metody rascheta. Novosibirsk, Red.izd.
otdel Sibirskogo otd-niia AN SSSR, 1964. 369 p.
(MIRA 17:8)

BERDYSHEV, G.D.; SIFLIVINSKII, V.N.; SHALINA, L.V., red.

[V.V.Sapozhnikov, prominent Siberian scholar and traveler]
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nauk, red.; .. .DER, A.I., kand. tekhn. nauk, red.;
SHMIDT, L.... red.

[Automatic control and electrical measuring techniques,
transactions] Avtomaticheskii kontrol i metody elektri-
cheskikh izmerenii; trudy. Novosibirsk, Red.-izd. otdel
Sibirskogo otdelnia AN SSSR, Vol... [Electrical measuring
techniques. Analysis and synthesis of regulation and
control systems. Elements of automatic control devices]
Metody elektricheskikh izmerenii. Analiz i sintez sistem
upravlenia i kontrolia. Elementy ustroistv avtomatiche-
skogo kontrolia. 1964. .50 p.   (MIRA 17:7)

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Novosibirsk, 1961. 2. Chlen-korrespondent AN SSSR (for
Karandeyev).

LEVCHENKO, D.G.; KOTYUK, A.F., kand. tekhn. nauk, otv. red.;
    SHALINA, L.V., red.

    [Two-frequency inductive electric prospecting apparatus]
    Apparatura dvukhchastotnoi induktivnoi elektrorazvedki.
    Novosibirsk, Red.-izdatel'skii otdel Sibirskogo otd-niia
    AN SSSR, 1964. 92 p.   (MIRA 18:3)

KARANDEYEV, K.B.; otv. red.; SOBOLEVSKIY, K.M., kand. tekhn. nauk, red.; TSAPENKO, M.P.; doktor tekhn. nauk, red.; SHALINA, L.V.; red.

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(MIRA 18:5)

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DONARETSKII, A.N.; IVANOV, L.N.; KARYSHEV, Ye.N.; SINITSYN, B.S.;
        SHALINA, L.V., red.

        [Discrete measuring correlation system (DIKS)] Diskret-
        naia izmeritel'naia korreliatsionnaia sistema (DIKS).
        Novosibirsk, Nauka, 1965. 107 p.   (MIRA 19:1)